Study shows loss of 15-42 percent of mammals in North America

December 17 2009

If the planet is headed for another mass extinction like the previous five, each of which wiped out more than 75 percent of all species on the planet, then North American mammals are one-fifth to one-half the way there, according to a University of California, Berkeley, and Pennsylvania State University analysis.

Many scientists warn that the perfect storm of global warming and environmental degradation - both the result of human activity is leading to a sixth mass extinction equal to the "Big Five" that have occurred over the past 450 million years, the last of which killed off the dinosaurs 68 million years ago.

Yet estimates of how dire the current loss of species is have been hampered by the inability to compare species diversity today with the past.

By combining data from three catalogs of mammal diversity in the United States between 30 million years ago and 500 years ago, UC Berkeley and Penn State researchers show that the bulk of mammal extinctions occurred within a few thousand years after the arrival of humans, with losses dropping after that. Although modern humans emerged from Africa into Europe and Asia by about 40,000 years ago, they didn't reach North American until about 13,000 years ago, and most mammal extinctions occurred in the subsequent 1-2,000 years.

"The optimistic part of the study is that we haven't come all that far on

extinction in the past 10,000 years," said co-author Anthony Barnosky, UC Berkeley professor of integrative biology. "We have this pulse when humans had their first effect about 13,000 years ago, but diversity has remained pretty steady for about 10,000 years."

He expects to see a similar pattern in Europe after the invasion of Homo sapiens some 40,000 years ago.

In the last 100 or so years, however, "we are seeing a lot of geographic range reductions that are of a greater magnitude than we would expect, and we are seeing loss of subspecies and even a few species. So it looks like we are going into another one of these extinction events."

"I'm optimistic that, because we haven't lost those species yet, if we redouble our conservation efforts we can stem the tide of extinctions and have those species around in the future," he added.

The study's 30 million-year timeline allowed the researchers to compare species diversity over a period of dramatic change in the landscape. The Rocky Mountains and Sierra Nevada ranges formed in the West, while there were dramatic swings in climate that may have been larger than and as fast as the Earth is seeing today, said co-author and UC Berkeley research associate Marc A. Carrasco. Yet these changes did not have a great effect on mammal diversity, compared to what happened when the last glacial period ended, the ice retreated in North America, and humans crossed from Asia into America.

"The only difference is that 13,000 years ago humans appear on the scene," Carrasco said. "The bottom line is, mammals in general were able to deal with these changes in the past. Only when humans arrive do the numbers fall off a cliff."

The analysis by Barnosky, Carrasco and Russell W. Graham, professor

of geosciences at Penn State in University Park, Pa., appears online this week in the open-access journal *PLoS One*.

Their analysis combined two databases compiled over the past 15 years ago by Graham and one database created by a UC Berkeley team led by Barnosky and Carrasco in the past few years. Graham's databases are FAUNMAP I, which lists all mammal fossils and their geographic ranges in the United States between 40,000 and 500 years ago, and FAUNMAP II, a compilation of mammalian fossils dating from 40,000 to 5 million years ago. The UC Berkeley database is MIOMAP, which includes all fossil occurrences in the U.S. between 5 and 30 million years ago, which covers the Miocene and part of the Oligocene periods. The databases include all terrestrial mammals from shrews to mammoths, except bats.

If similar databases were analyzed for other terrestrial species, such as reptiles or birds, scientists could look for similar patterns, the researchers say. However, few plant or animal groups produce the abundant fossil record of mammals, Carrasco said.

If a similar analysis of European mammal extinctions were performed, Barnosky said, he expects that it would show a similar pulse of extinction following the arrival of humans, followed by a leveling off until the present day. He ascribes that initial pulse of extinction to a synergistic effect of burgeoning humanity and natural global warming after the Ice Age.

"Now here we are again, astronomically increasing the number of humans on the face of the globe, plus unusual climate change," he said. "That seems to be a recipe for extinction that we saw in past and we are seeing again."

The team hopes to extend its analysis to mammals in other areas of the

globe, and use the database to monitor the pace of mammal extinctions.

"One strength of the analysis is that it provides a baseline for judging not only the past, but the future," Carrasco said.

"There is a bit of urgency here, Barnosky said. "By demonstrating that we have already lost 15 to 42 percent of mammalian diversity, the question is, Do we really want to lose any more. I think the answer to that is pretty obvious."

Provided by University of California - Berkeley